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# Results on main elasmobranch species captured in the bottom trawl surveys on the Northern Spanish Shelf

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## Abstract

*This working document presents the results on the significant elasmobranch fish species captured in the Spanish Groundfish Survey on Northern Spanish shelf in 2011. The main species in biomass terms in this survey, in decreasing abundance order, were Scyliorhinus canicula, Galeus melastomus and Raja clavata (altogether made up a 91% out of the total of elasmobranches fish species). With less abundance also Leucoraja naevus, Raja montagui and Etmopterus spinax were recorded (7% out of the total of elasmobranches fish species), followed by other less important in biomass terms (2% out of the total of elasmobranches fish species). Biomass, geographic distribution and length ranges were analysed. Galeus melastomus and Etmopterus spinax dwell deeper areas than Scyliorhinus canicula, Raja clavata, Leucoraja naevus and Raja montagui do.*

## Introduction

The bottom trawl survey on the Northern Spanish Shelf aims to provide data and information for the assessment of the commercial fish species and the ecosystems on the Galician and Cantabrian shelf (ICES divisions VIIIc and IXa North) together with studying the distribution of the main benthic and demersal species and the environmental factors driving it. The Spanish bottom trawl survey on the northern Spanish shelf has been carried out every autumn since 1983 except for 1987 (ICES, 2010).

The aim of this working document is to report the results (abundance indices, length distributions and geographic and bathymetric distributions) on the most common elasmobranch fish species in 2011 survey after the results presented in Ruiz-Pico *et al.* (2011). The species registered in 2011 in the sampling area were: *Scyliorhinus canicula*, *Galeus melastomus*, *G.atlanticus*, *Etmopterus spinax*, *Raja clavata*, *Raja montagui*, *Leucoraja naevus*, *Hexanchus griseus*, *Scyliorhinus stellaris*, *Raja brachyura*, *Leucoraja circularis*, *Scymnodon ringens*, *Etmopterus pusillus* and *Deania profundorum*.

## Material and methods

The survey was carried out on board the R/V "Cornide de Saavedra", between October 1st and November 3rd, 2011.

The standard IBTS methodology for the western and southern areas (ICES, 2010) was applied. The sampling design used was random stratified with five geographical sectors: MF (Miño-Finisterre), FE (Finisterre-Estaca de Bares), EP (Estaca de Bares – Peñas), PA (Peñas-Ajo) and AB (Ajo-Bidasoa) (Figure 1). The depth stratification was changed in 1997 from 30-100 m, 101-200 m, 200-500 m to 70-120 m, 121-200 m and 201-500 to overcome the shortage of grounds shallower than 70 m that hindered the representative coverage of this stratum. Hauls shallower than 70 m and deeper than 500 m are considered additional hauls and performed every year if possible, though they are not included in the stratified abundance indices; nevertheless they are performed and plotted in the distribution maps. The information from these depth ranges is considered relevant due to depth changes of fishing activities in the area (Punzón et al. 2011a). To determine the depth range of these species additional hauls were also considered.

## Results

Sampling carried out (Figure 1) consisted of 112 standard hauls, being one of them null, and 11 additional hauls, 2 of them shallower than 70 m, and 9 deeper than 500 m. Mean total catch per haul was 128.14 ± 31.14 kg. Fishes represented about 83% of the total catch while elasmobranchs made up ca. 14% of the total fish catch. On the whole, three big groups of elasmobranch fish species can be identified in terms of biomass importance:

- *Scyliorhinus canicula*, *Galeus melastomus* and *Raja clavata* (91% out of the total of elasmobranches fish species).
- *Leucoraja naevus*, *Raja montagui* and *Etmopterus spinax* (7% out of the total of elasmobranches fish species)
- Others less important in biomass terms (2% out of the total of elasmobranches fish species): *Galeus atlanticus*, *Hexanchus griseus*, *Scyliorhinus stellaris*, *Raja brachyura*, *Leucoraja circularis*, *Scymnodon ringens*, *Etmopterus pusillus*, and *Deania profundorum*.

A chart with depth distribution in 2011 is shown for the most abundant species (Figure 20).

### *Scyliorhinus canicula (Lesser spotted dogfish)*

In 2011 this species represented about 48% of the total elasmobranchs stratified biomass caught, and it was found only in two of the additional shallower hauls, showing a depth range from 33 to 594 m in the overall time series.

The differences in biomass terms between the IXaN and VIIIc divisions from 2006 to 2011 were lower than in the previous period due to the marked increase in division IXaN (Figure 2, Figure 3). In 2011 there was a slight decrease in the biomass index both in the VIIIc and IXaN division. The percentage of *S. canicula* biomass in the total fish biomass catch rate ranged from 1.7% (2.15 $kg \cdot haul^{-1}$) in 1983 to 6.6% in 2011 (6.58 $Kg \cdot haul^{-1}$).

In the last survey, lesser spotted dogfish length size ranged from 10 to 58 cm in IXaN division, showing similar sizes to the mean values of the last ten year of the historical series, though there was an increase in the abundance of higher sizes (Figure 4). In division VIIIc, similar size values to the mean values of the last decade were found, from 13 to 71 cm, displaying an increase in the intermediate size values.

Geographically, in 2011, higher abundance indices were found in the central region of the Cantabrian Sea (EP and PA sectors) while a lower abundance is observed in other sectors compared to previous years.

### *Galeus melastomus (Blackmouth catshark)*

This species is the second one in biomass terms out of the total of elasmobranch fish species in 2011; about 22%, with a stratified biomass of 3.04 Kg per haul (taking into account only the standard hauls). The distribution of *Galeus melastomus* extends from 143 to 808 m from 2009 and 2011.

Before 2009, *Galeus melastomus* had been recorded together with *Galeus atlanticus* as this last species was described recently within the area (Rey *et al*, 2006; Castilho *et al*, 2007). Previous results on elasmobranchs in the area presented the data for both species together as *Galeus* spp. (Ruiz-Pico *et al*., 2011). This working document presents the results for both species split since there are already three years that allow to do a comparative analysis. *Galeus atlanticus* constitutes only the 2.25% out of the capture of both species together. (Figures 5a-c; 6a-c; and Figures 7a-d).

Considering the whole time series and both species combined, a rising trend can be observed since 2008, though there was a decrease in the abundance found in IXaN division (Figure 5a).

In a comparative view, some differences can be noticed. Mainly, *G. atlanticus* has not been found in the stratified hauls in IXaN division, nevertheless it has been found in hauls deeper than 500 m (Figure 6c) and its abundance has fallen from 2008 in stratified hauls (Figure 5c), while the stratified biomass of *Galeus melastomus* (Figure 5b) increased slightly in 2011 in the standard hauls off the Cantabrian coast (VIIIc division) and this species also increased its abundance in IXaN division, although off Galician waters captures are not reflected in the chart for this year because all the specimens were found in hauls out of the stratified area (hauls deeper than 500m) (Figure 5b, Figure 6b).

Regarding length distribution, in the last three years of the time series *G.melastomus* length sizes (Figure 7b) have a wider range in VIIIc (fom 14 to 74cm) than in IXaN division (from 14 to 42 cm). In 2011 the sizes range followed the pattern of the last three years for the VIIIc division, without stratified data for this year in the IXa division. These species are usually found on the outer continental shelf and upper slope at depths from 100 m-1200m. In these surveys main catches are found close to 600 m deep (Figure 20; Figure 7d). For this reason abundance indices must be taken with caution since they do not cover the whole depth range of this species.

In 2011 the mode is not so clear as it was in the period from 2009 to 2011, between 26 and 32 cm. *G.atlanticus* presented a narrower length range for VIIIc division between 2009 and 2011, from 19 to 59, with the mode around 40 cm (Figure 7c).

Depth distribution for both species, *G. atlanticus* and *G. melastomus* has been included for the last survey (Figure 7d). This graph shows a narrower distribution for *G. atlanticus* almost restricted to deeper 500m hauls.

### *Raja clavata (Thornback ray)*

This species made up about 21% of the total elasmobranchs stratified biomass caught in 2011, dwelling in depths between 35 and 697 m in the overall time series.

In 2011, the IXaN division displayed a strong drop in the captures compared to the previous year with the highest catches in the time series, while in the VIIIc division, the biomass recovered toward 2006 and 2007 levels (Figure 8; Figure 9).

Thornback ray individuals caught in 2011 ranged from 14 to 93 cm (Figure 10), being consistent with the historical series.

***Leucoraja naevus (cuckoo ray)***

This species represented about 3% of the elasmobranchs total stratified biomass caught in 2011, with a depth range from 35 to 590 m in the overall time series, though usually close to 200 m depth (Figure 20). No catches of this species are recorded in IXa division along the whole time series (Figure 12). The main distribution of this species is found in the central area of the Cantabrian Sea (sectors EP and PA) similar to previous years.

In 2011 a slight increase in the biomass of *L. naevus* was found compared to previous years, however the biomass indices show annually slight fluctuations between 0.2-0.6 kg/haul (Figure 11). Cuckoo ray length distribution ranged from 20 to 65 cm in 2011 (Figure 13), with no clear mode.

***Raja montagui (Spotted ray)***

*R. montagui* represented close to 3% of the total elasmobranchs stratified biomass caught in 2011. The depth distribution of this species extends from 35 to 564 m throughout the time series. In the last year, the VIIIc division showed a drop of the biomass after the peak in 2010, remaining the downward trend from 2005 (Figure 14). As for *L.naevus*, no records of *R. montagui* have been found in the IXaN division for the whole historical series. The spatial distribution of the catches shows that *R. montagui* was mainly found in the central region of the Cantabrian Sea (sectors EP and PA) while is noteworthy the lowest catches found in other areas compared to previous years (Figure 15).

Spotted ray length size ranged from 13 to 76 cm in 2011 (Figure 16), with the mode around the size of 50cm, following the trend of the historical series.

***Etmopterus spinax (Velvet belly)***

This species only represented about 1% of the total elasmobranchs stratified biomass in 2011. The distribution of this species regarding depth extends from 230 to 704 m in the overall time series.

*E. spinax* occurred especially in Galician waters but in deeper waters than in the Cantabrian Sea (VIIIc division). In the last year, the VIIIc division showed a slight rise in the stratified biomass of *E. spinax*, following a general increasing trend from 1995 (Figure 17). In the IXaN division, the stratified biomass was not shown because all specimens were found in hauls deeper than 500 m (Figure 18), and thus the stratified biomass is nil.

Velvet belly length distribution found in the last decade ranged between 8 and 40 cm. In 2011 the size range varied from 11 to 37 cm, with a mode between 14 and 16 cm, somewhat lower than the values of the historical series (Figure 19).

However, as in the case of *G. melastomus*, this species is found at deeper waters than those covered by this survey and thus the abundance indices must be taken with caution. Length distribution (Figure 19) probably is also affected by the depth range covered in the survey.

## Other elasmobranch species

Other species were caught during the 2011 survey with much less abundance than the species analysed above, comprising the 2% of the total elasmobranches fish species: *H. griseus, S.stellaris, R.brachyura, L. circularis, S. ringens, E. pusillus, D. profundorum* and *Rajella* sp.


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# Figures

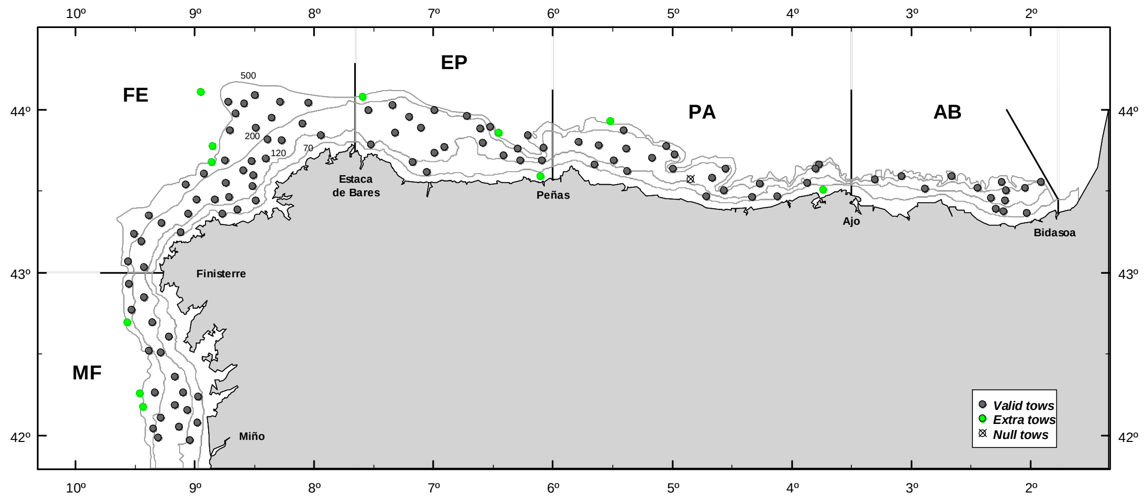


**Figure 1.** Stratification design and hauls on the Northern Spanish Shelf Groundfish survey in 2011; depth strata are: A) 70-120 m, B) 121 – 200 m and C) 200 – 500 m. Geographic surveys are MF: Miño-Finisterre, FE: Finisterre-Estaca, EP: Estaca-cabo Peñas, PA: Peñas-cabo Ajo, and AB: Ajo-Bidasoa.

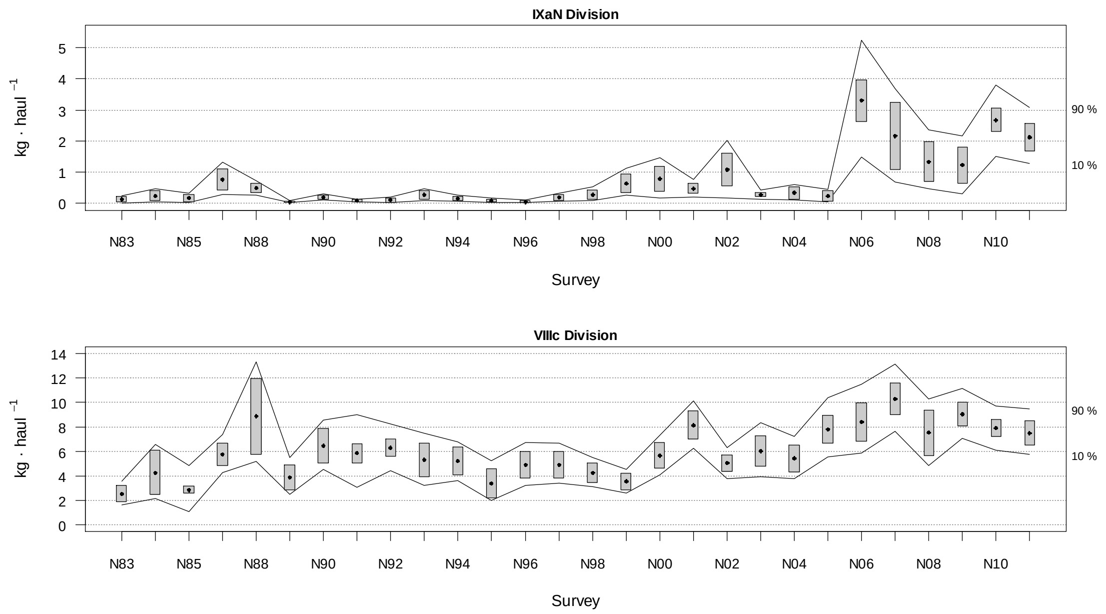


**Figure 2.** Changes in *Scyliorhinus canicula* biomass index during the North Spanish shelf bottom trawl survey time series (1983-2011 but in 1987) in the two ICES divisions covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000).

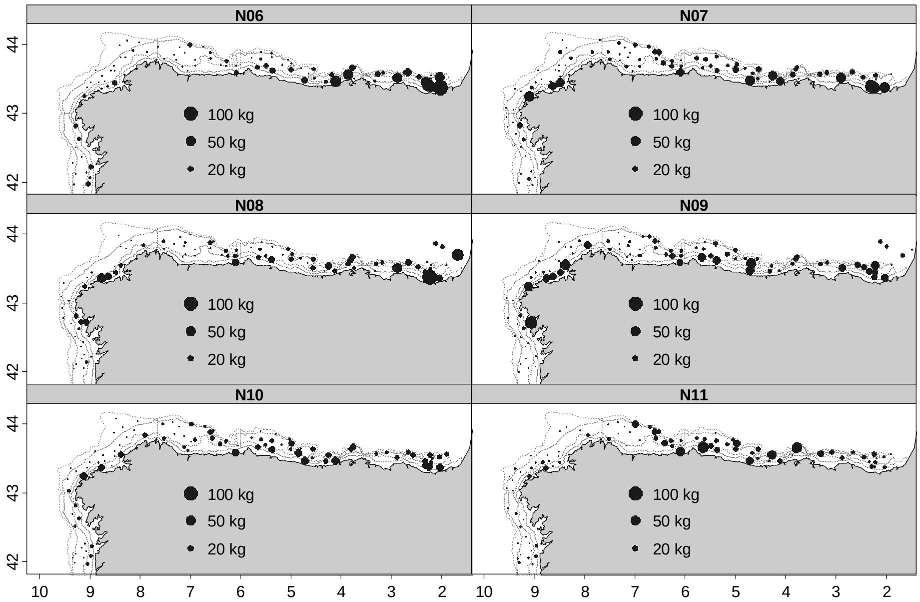


**Figure 3.** Geographic distribution of *Scyliorhinus canicula* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2006 and 2011.

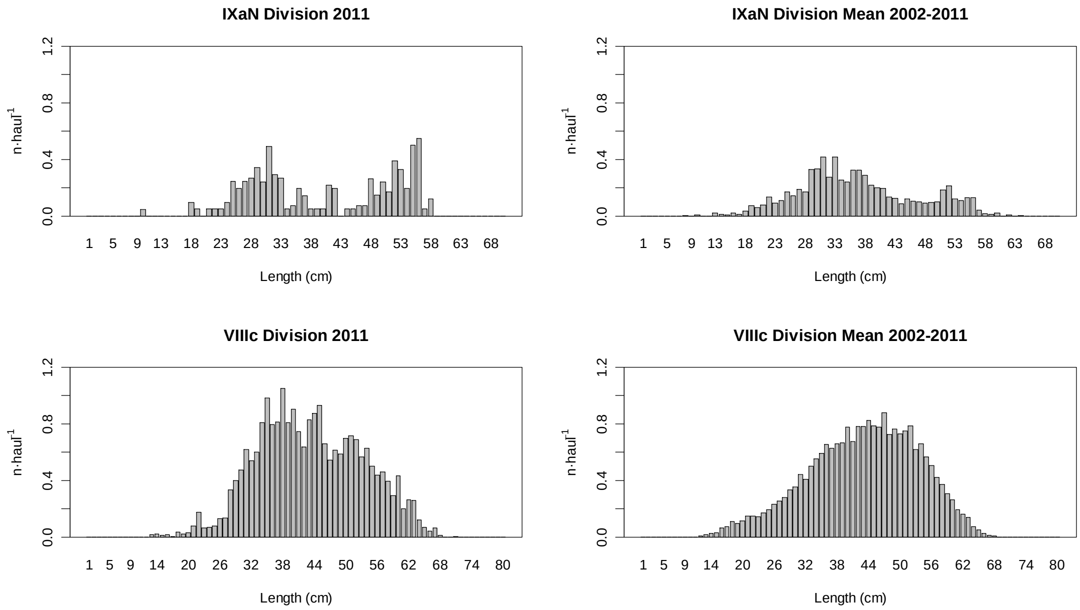


**Figure 4** Stratified length distributions of *Scyliorhinus canicula* in 2011 in the two ICES divisions covered by the North Spanish Shelf bottom trawl survey, and Mean values for the last decade in both areas (2002-2011).

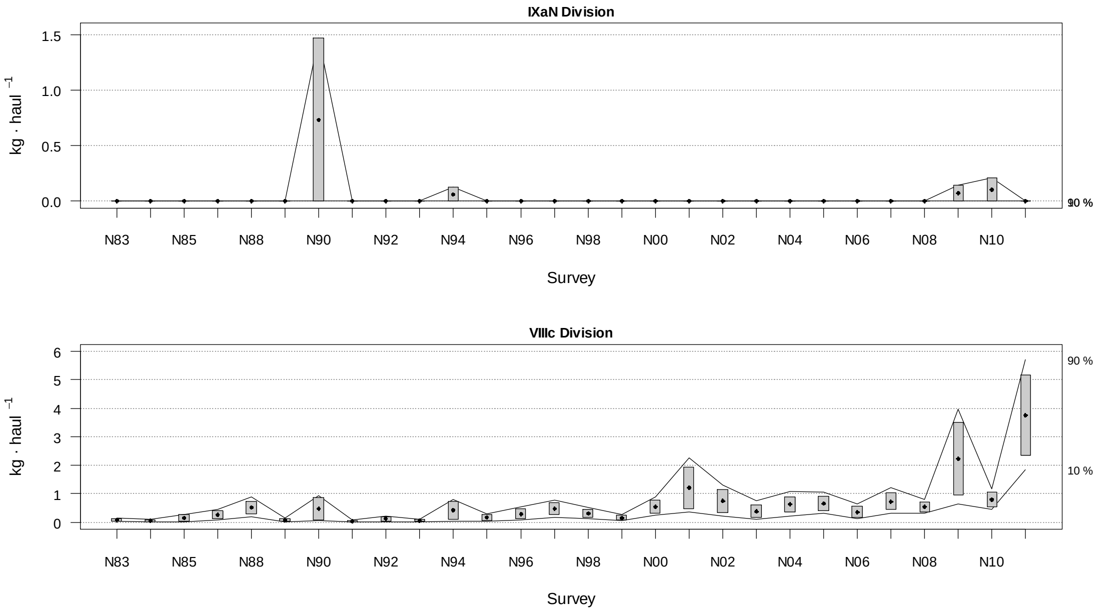


**Figure 5a.** Changes in *Galeus spp. (G.melastomus and G.atlanticus)* biomass index during the North Spanish shelf bottom trawl survey time series in the ICES division covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000).

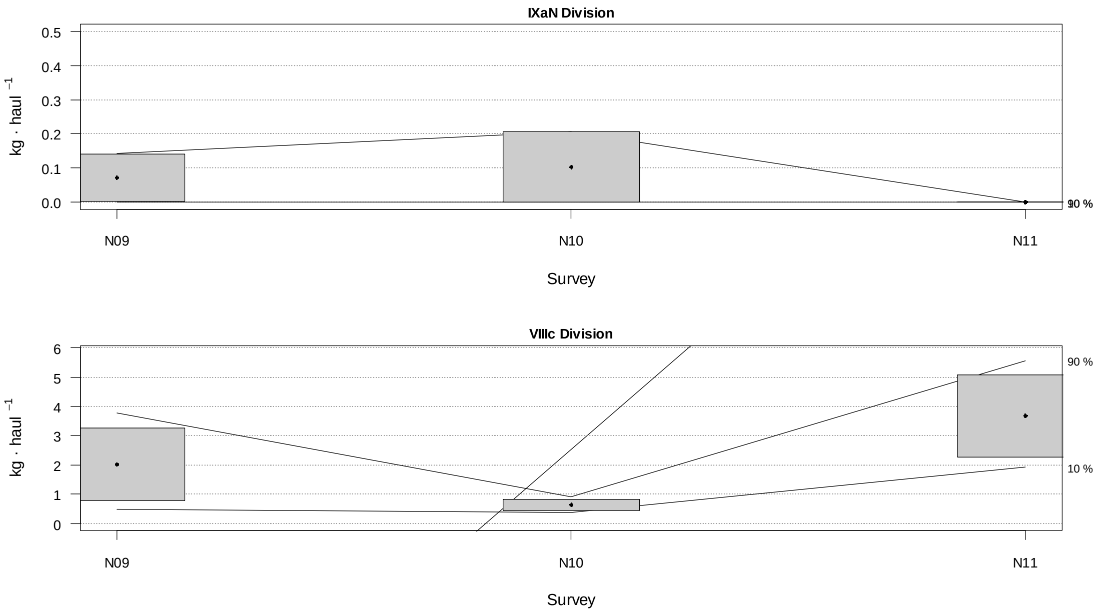


**Figure 5b** Changes in *Galeus melastomus* biomass index during the North Spanish shelf bottom trawl survey time series (2009-2011) in the two ICES divisions covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000).

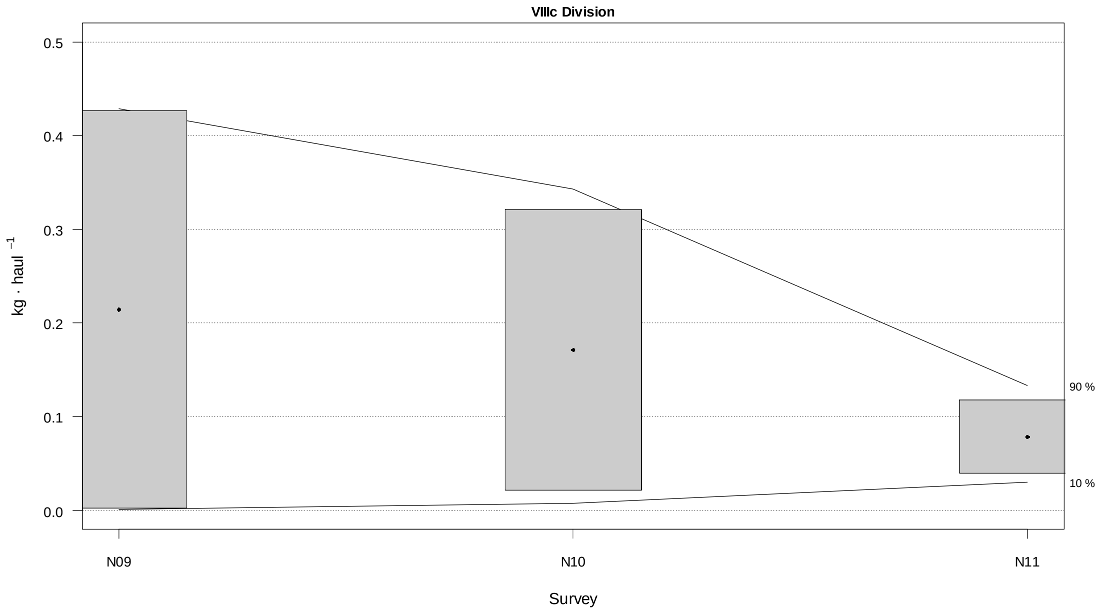


**Figure 5c.** Changes in *Galeus atlanticus* biomass index during the North Spanish shelf bottom trawl survey time series (2009-2011) only in the VIIc ICES division, as the other division covered by the survey (IxaN) had not any capture of G. Atlanticus in the sttratified hauls. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000).

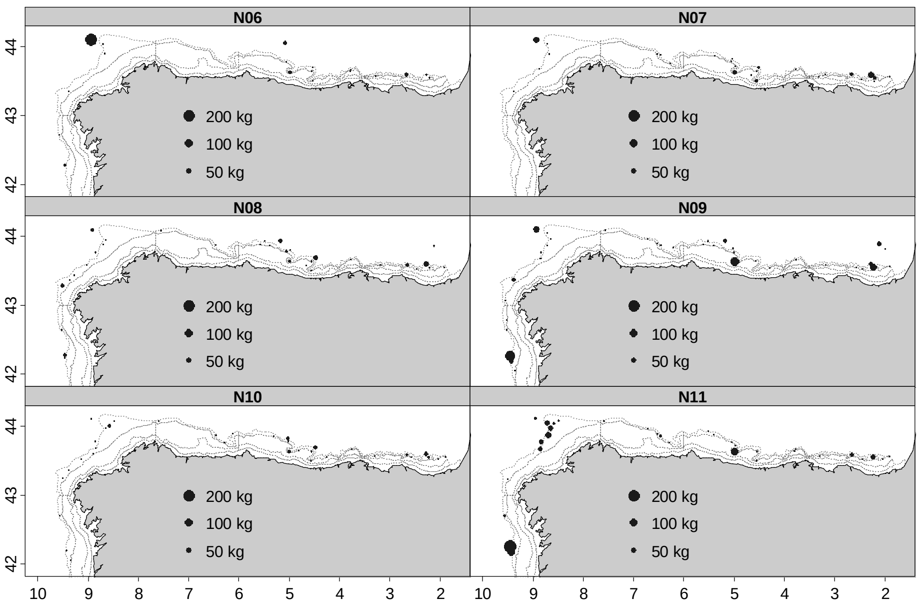


**Figure 6a.** Geographic distribution of *Galeus spp. (G. melasomus* and *G.atlanticus)* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2006 and 2011.

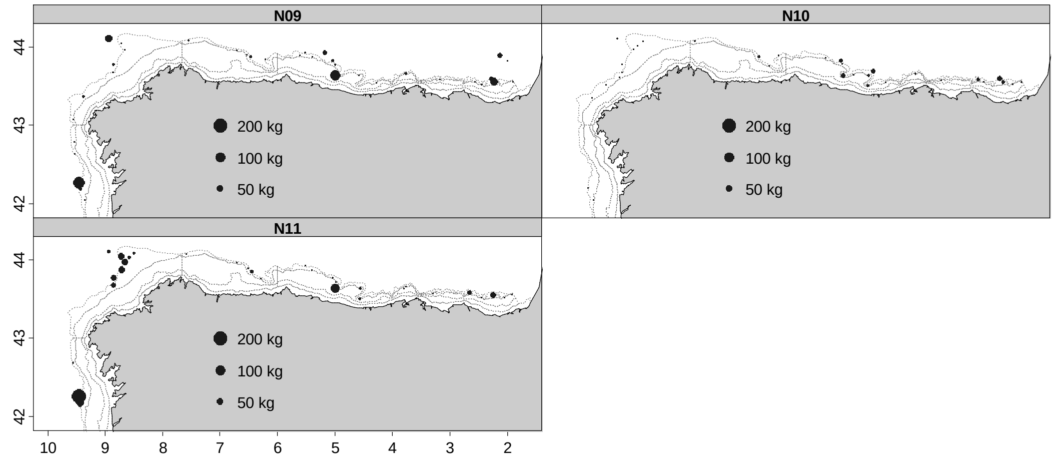


**Figure 6b.** Geographic distribution of *Galeus melastomus* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2009 and 2011.

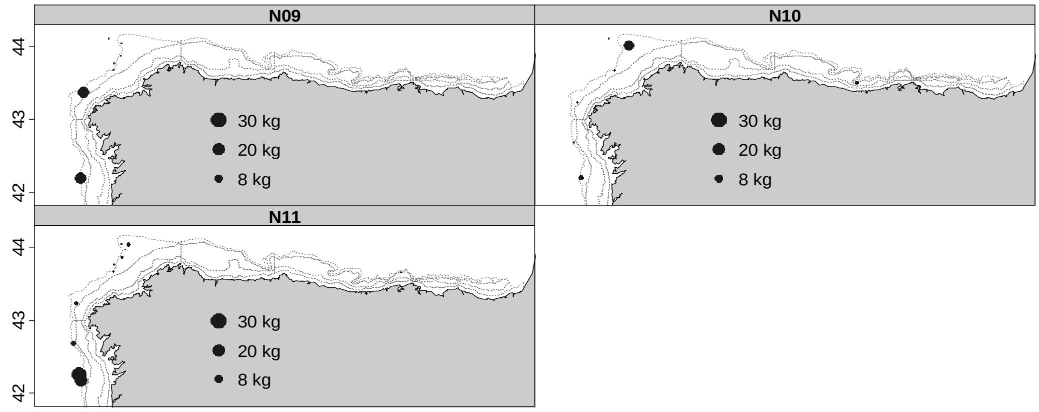


**Figure 6c.** Geographic distribution of *Galeus atlanticus* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2009 and 2011.

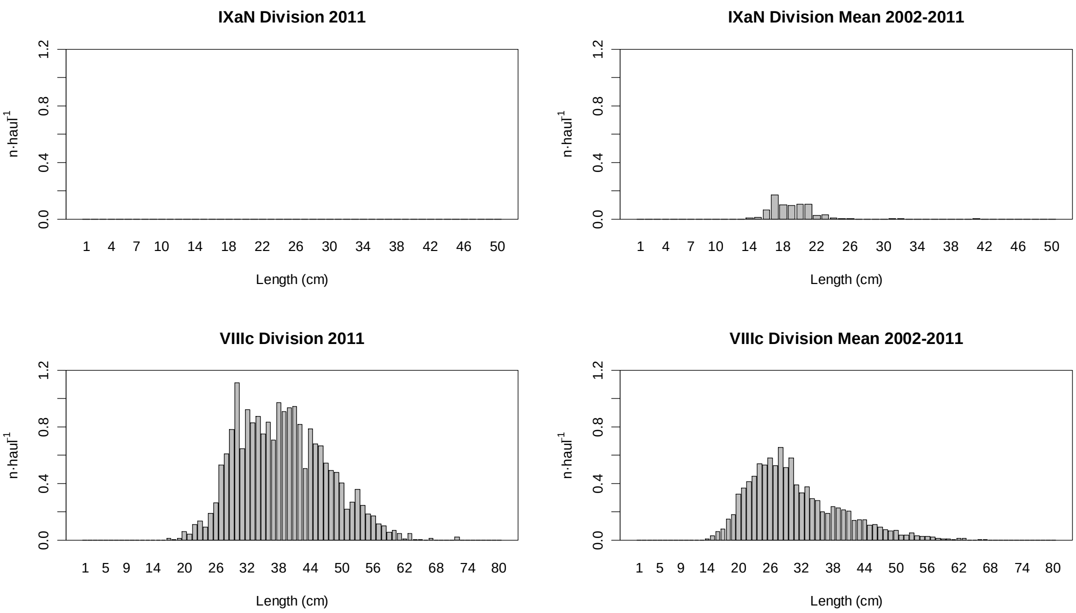

**Figure 7a.** Mean stratified length distributions of *Galeus* spp *(G.melastomus* and *G.atlanticus* together*)* in the North Spanish Shelf surveys (2002-2011)

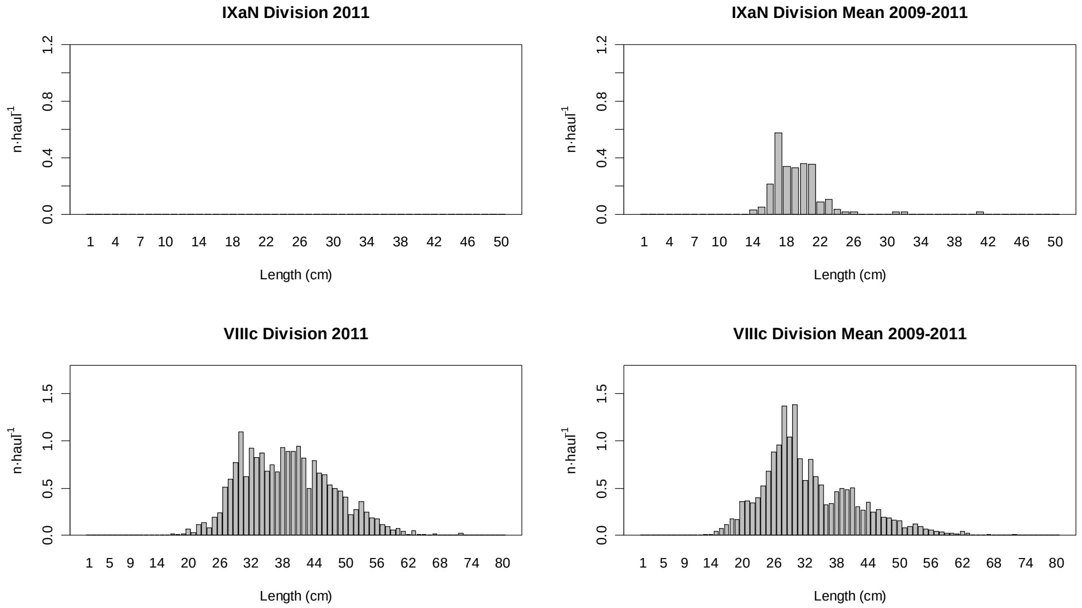


**Figure 7b.** Mean stratified length distributions of *Galeus melastomus* in the North Spanish Shelf surveys (2009-2011).

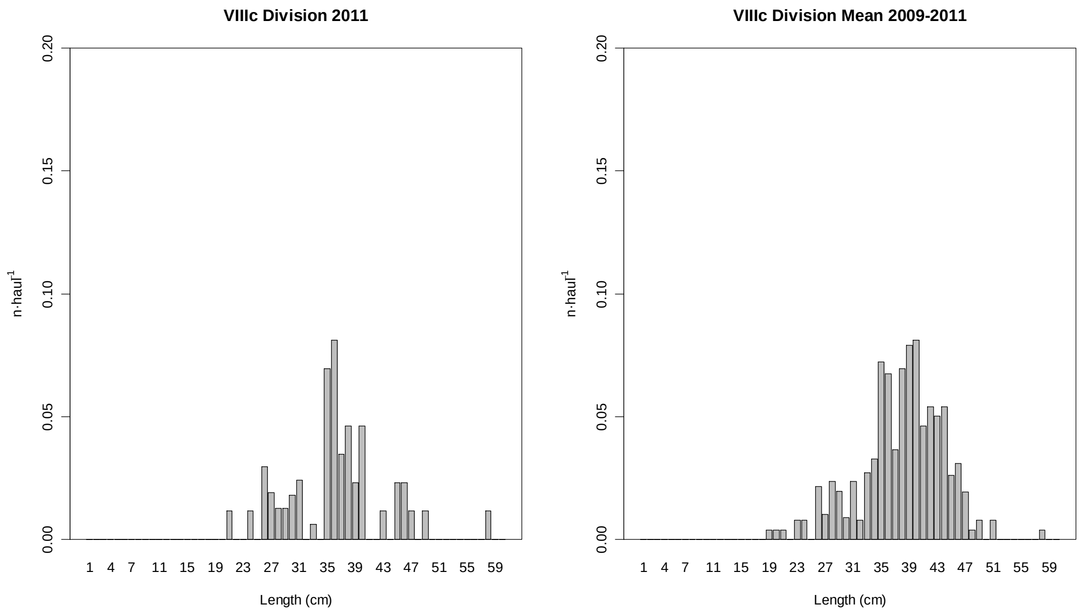


**Figure 7c.** Mean stratified length distributions of *Galeus atlanticus* in the North Spanish Shelf surveys (2009-2011)

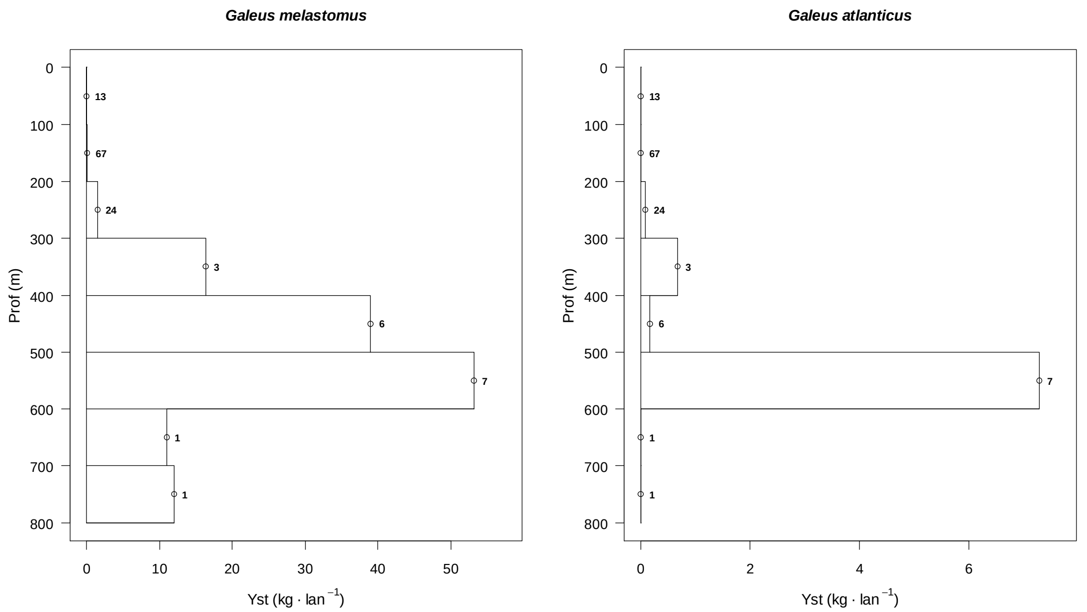


**Figure 7d.** Depth distribution of *G.melastomus* and *G.atlanticus* for the 2011 survey, values on the right are the number of hauls carried out in each depth interval

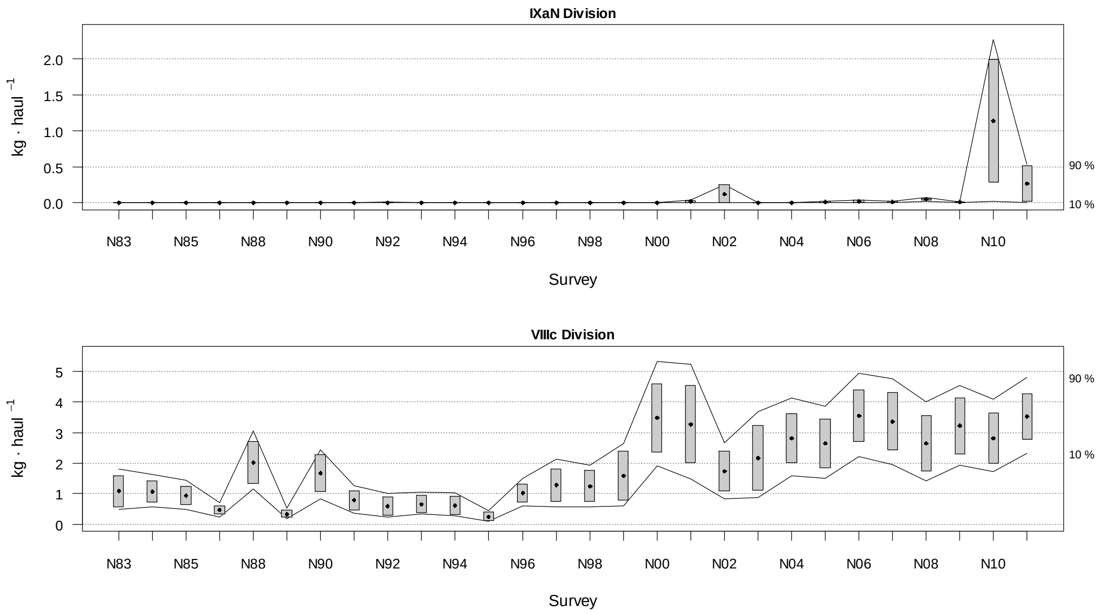


**Figure 8** Changes in *Raja clavata* biomass index during the North Spanish shelf bottom trawl survey time series (1983-2011 but in 1987) in the two ICES divisions covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

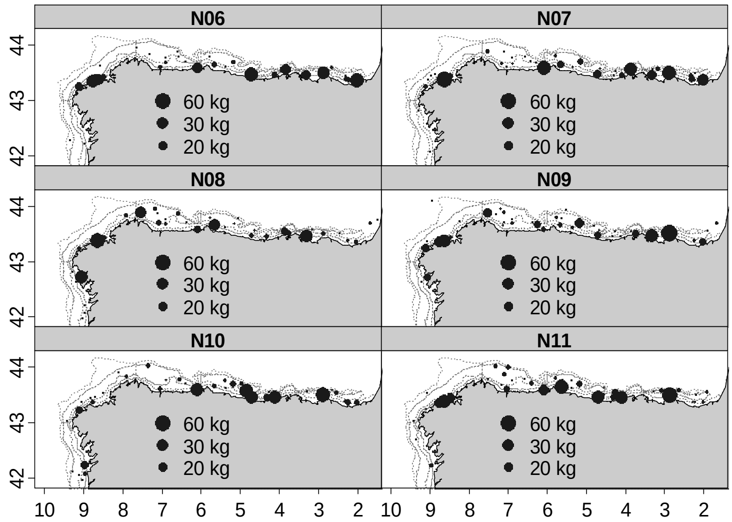


**Figure 9** Geographic distribution of *Raja clavata* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2006 and 2011

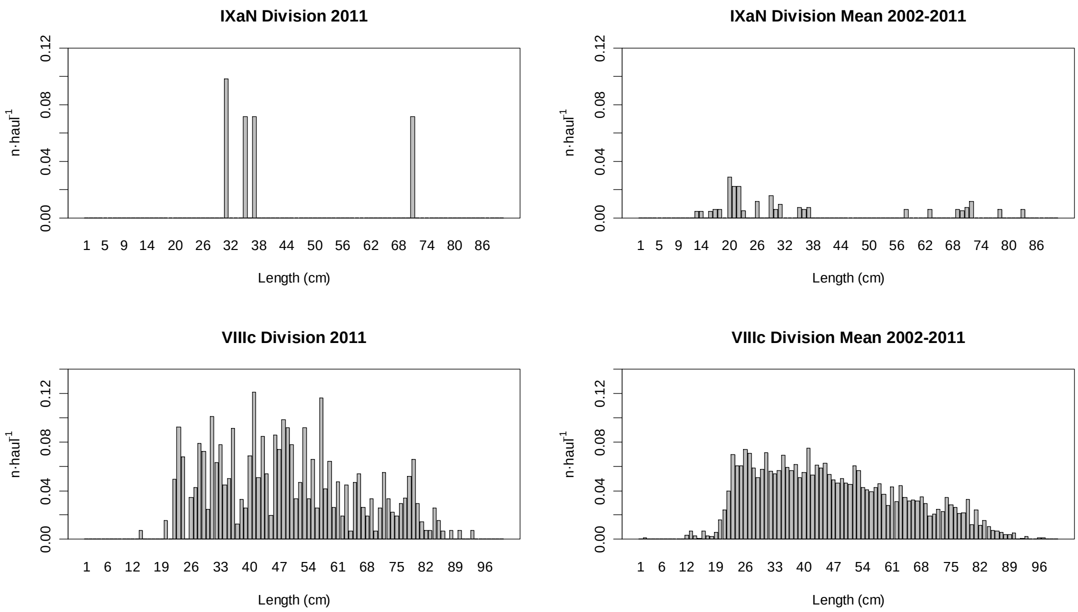


**Figure 10.** Mean stratified length distributions of *Raja clavata* in the North Spanish Shelf surveys (2002-2011)

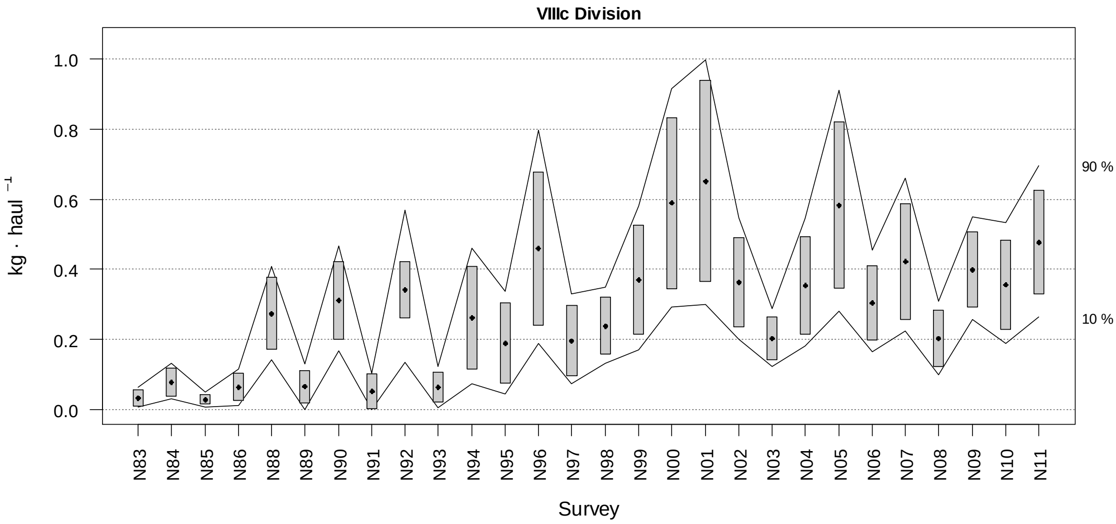


**Figure 11.** Changes in *Leucoraja naevus* biomass index during the North Spanish shelf bottom trawl survey time series (1983-2011 but in 1987) in the VIIIc division covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

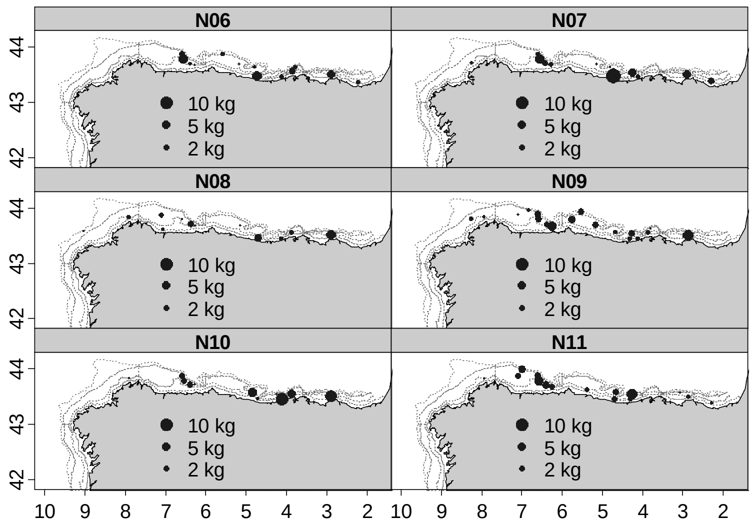


**Figure 12.** Geographic distribution of *Leucoraja naevus* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2006 and 2011

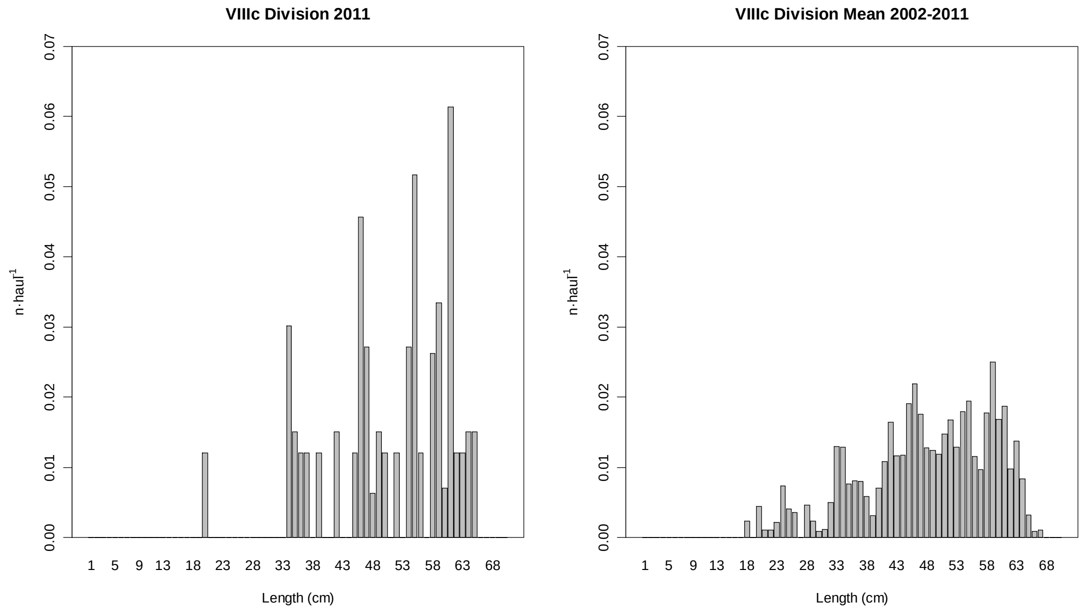


**Figure 13.** Mean stratified length distributions of *Leucoraja naevus* in the North Spanish Shelf surveys (2002-2011).

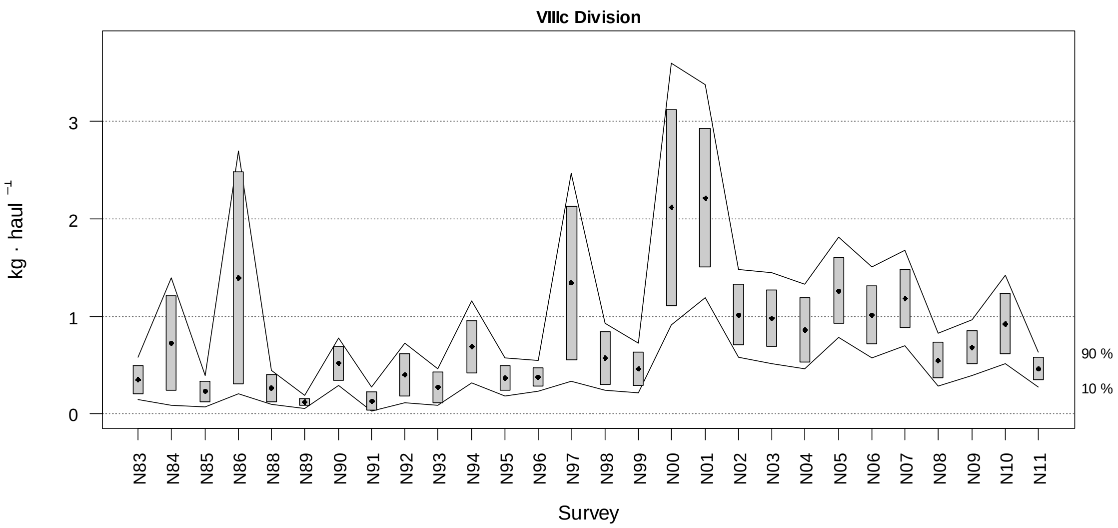


**Figure 14.** Changes in *Raja montagui* biomass index during the North Spanish shelf bottom trawl survey time series (1983-2011 but in 1987) in the VIIIc division covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

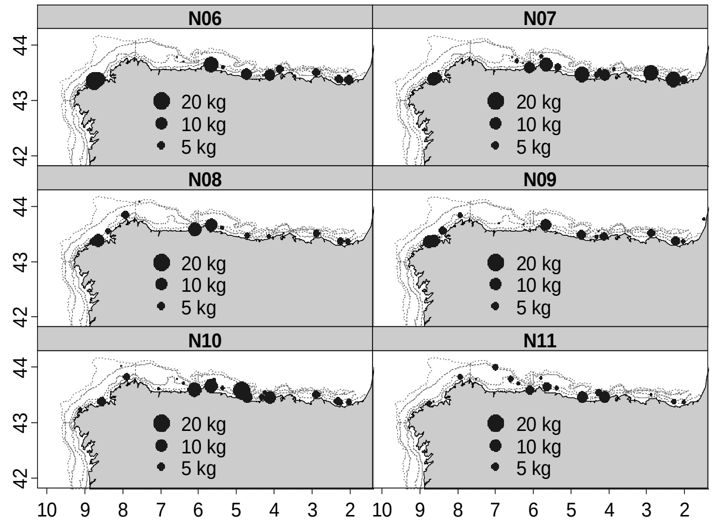


**Figure 15.** Geographic distribution of *Raja montagui* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2006 and 2011

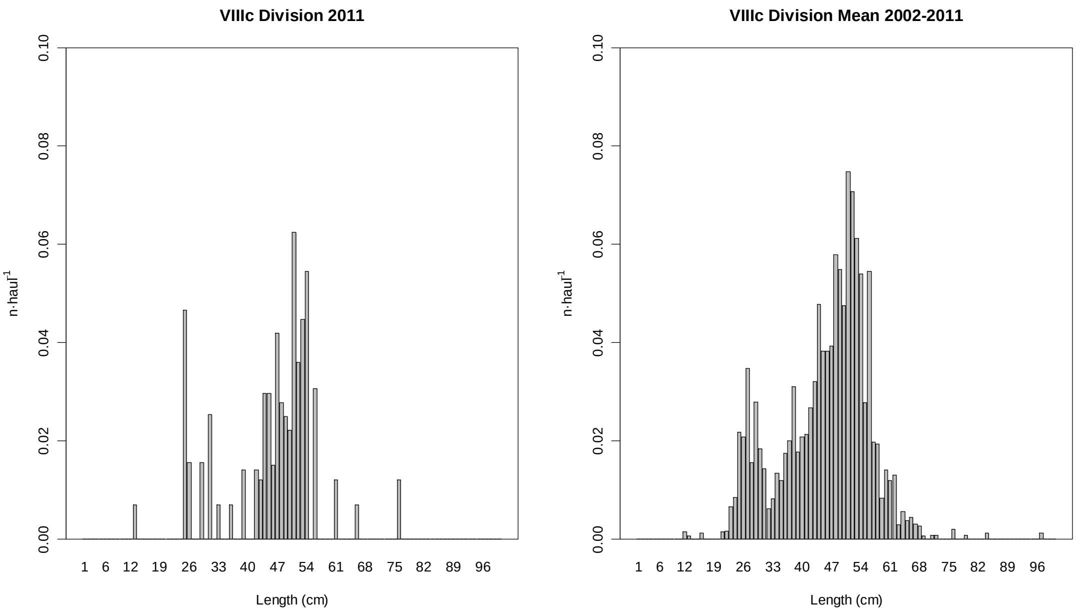


**Figure 16.** Mean stratified length distributions of Raja montagui in the North Spanish Shelf surveys (2002-2011)

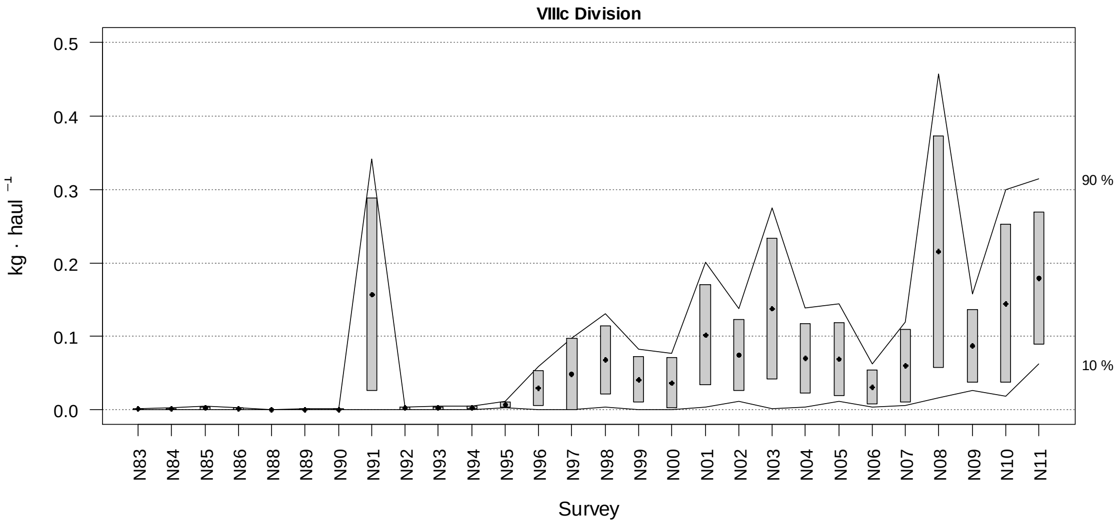


**Figure 17.** Changes in *Etmopterus spinax* biomass index during the North Spanish shelf bottom trawl survey time series (1983-2011 but in 1987) in the VIIIc division covered by the survey. Boxes mark parametric standard error of the stratified biomass index. Lines mark bootstrap confidence intervals (α= 0.80, bootstrap iterations = 1000)

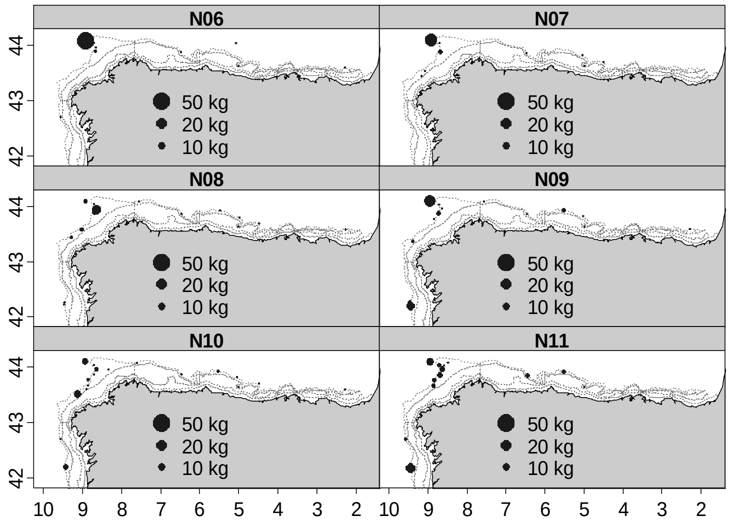


**Figure 18.** Geographic distribution of *Etmopterus spinax* catches (kg/30 min haul) in North Spanish Shelf bottom trawl surveys between 2006 and 2011

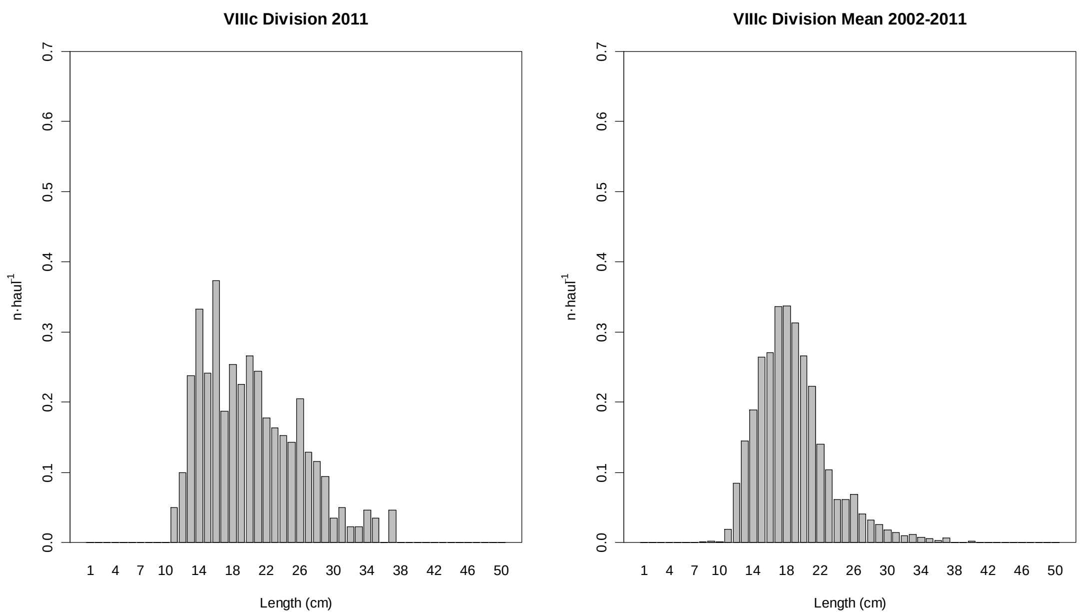


**Figure 19.** Mean stratified length distributions of *Etmopterus spinax* in the North Spanish Shelf surveys (2002-2011)

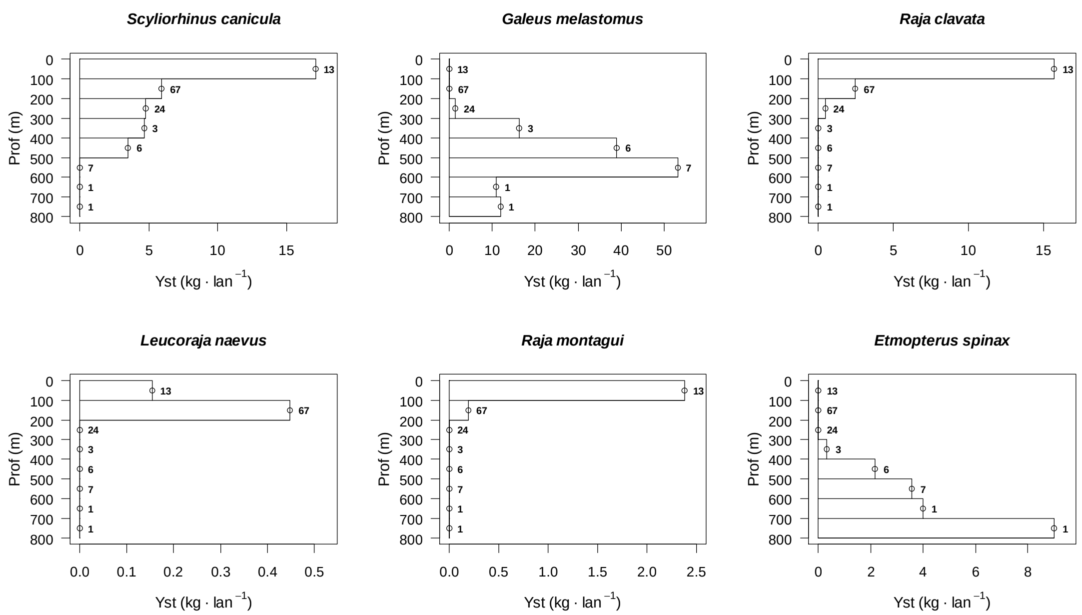


**Figure 20.** Depth distribution of the main elasmobranch fish species for the 2011 survey, values on the right are the number of hauls carried out in each depth interval